

Software architecture and **design**

6.1 Introduction

This phase is concerned with determining the appropriate software architecture then performing the software design. We will learn the different architectures of SW and the two main design approaches: structured design and object-oriented design.

In the design process, we aim to organize and decompose the system requirements collected at the analysis phase into interacting components ready to be implemented at the implementation phase. We have to ensure that the obtained design is a good design as it has many advantages as follows below. While badly designed SW will have the following disadvantages.

- **In this step, the system requirements are decomposed into a number of interacting components.**
- **A well designed system has the following advantages:**
 - **Easy to implement**
 - **Understandable**
 - **Reliable**
 - **Allows smooth evolution**
 - **Easy to maintain and test**

- **Badly designed systems:**
 - May work at first
 - Hard to maintain
 - Difficult to test
 - Unreliable
- To facilitate the design, we first make a top-level decomposition called “SW architecture”. Then we make the detailed design.

But before going into the detailed design, we can choose one of the architectures to follow through the design. Thus, the design phase is split into two subphases:

Design split into 2 sub-phases:

- **High-level or architectural design** : overall modules structure and the relationships among modules (or components)
- **Detailed design**: refine each module in detail and describe its algorithm and data structures

6.2 Sub-phase 1: SW Architecture

Large systems are often decomposed into subsystems that provide some related set of services. The initial design process of identifying these

subsystems and establishing a framework for subsystem control and communication is called SW architecture.

The software architecture is the fundamental framework for structuring the system. Architectural design decisions include decisions on: the application architecture, the distribution and the architectural styles to be used. Different architectural models such as: a structural (i.e. organizational) model, a control model and a decomposition model may be developed. We have a look for each of these models.

- **It is a top-level decomposition of a system into major components and their inter-relationship.**
- **It presents an abstract view of the sub-systems making up a system.**
- **Often graphical representations (block diagrams) called “global design”**

Purpose of SW architecture:

- 1- Used for communication with the customers, and users (as it is graphical description).**
- 2- Helps the designer to make early design decisions before making the detailed design.**

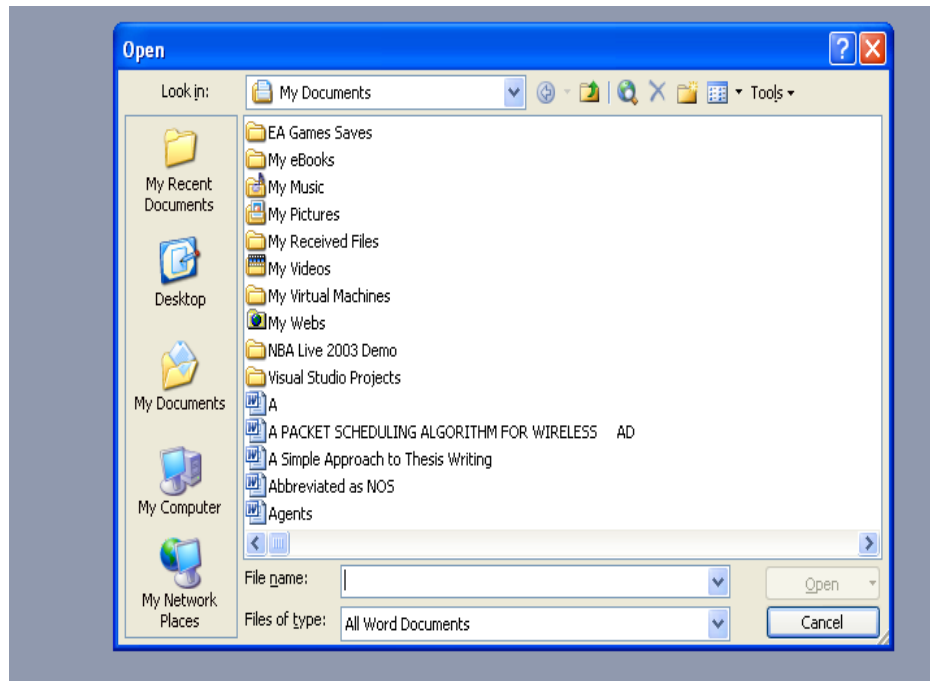
3- It can be used to produce other SW systems using the same architecture, i.e., product line of SW.

- **There are several factors that may affect the choice of SW architecture:**

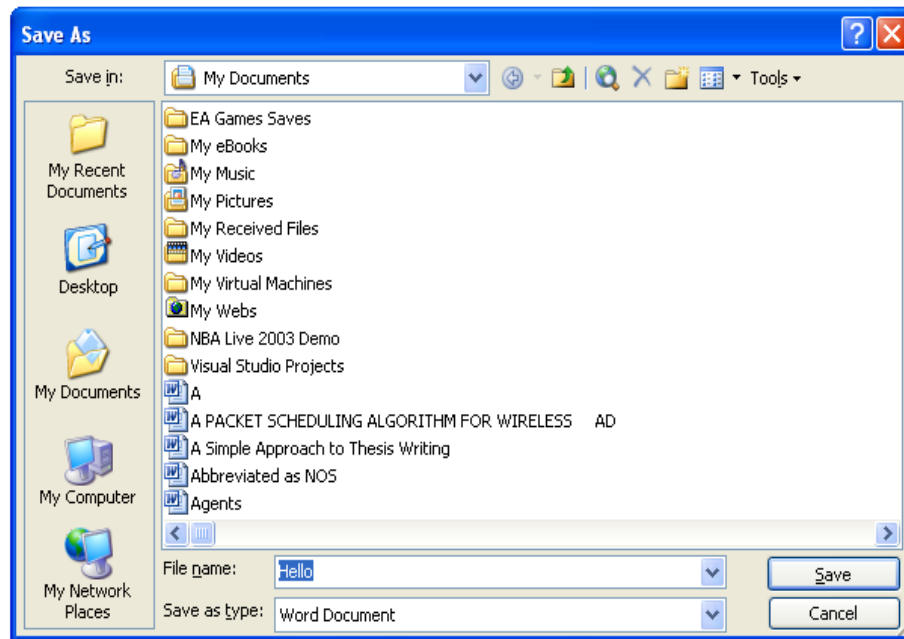
1- The organization constraints.

2- The background and expertise of the architect.

3- Some technical effects of the HW on the functions of the system.



This architecture facilitates the reuse of the available components and has many other advantages as above.

**Advantages:**

- The general services, which are mutual between more than one basic services, are not repeated for each service.
- Instead, only one copy is provided and all the basic services call it directly.
- This minimizes the size of code, time and cost taken to produce SW, and the complexity of the SW.

Sub-phase 2: SW design

The second sub-phase is the software design. This phase translates the

requirements into a design after specifying which architecture to be followed.

Definition:

- The design process is concerned with decomposing the system into modules such that each module has a lower complexity than the system as whole. The whole modules together satisfy the user requirements.
- The module is an identifiable unit in the design which has a specific task, inputs and outputs.
- The quality of the design reflects the quality of the resulting SW.
- Errors in the design show during the run-time of the SW, and require high cost to repair them.

6.4.1 SW design steps

- 1- The system is decomposed into less complex modules which is then decomposed into less complex modules ,...etc till we reach the lower simple level.
 - 2- For the lower levels, we draw a graphical representation of the algorithm to be performed.
 - 3- For each higher and lower modules, we gave to specify the function it performs.
 - 4- Determine the test cases to be used in the test phase.
 - 5- Write the design document to include all the previous steps.
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There are many levels of design in the system. The most famous of them are:

- 1- function design
- 2- database design
- 3- screen (interface design)